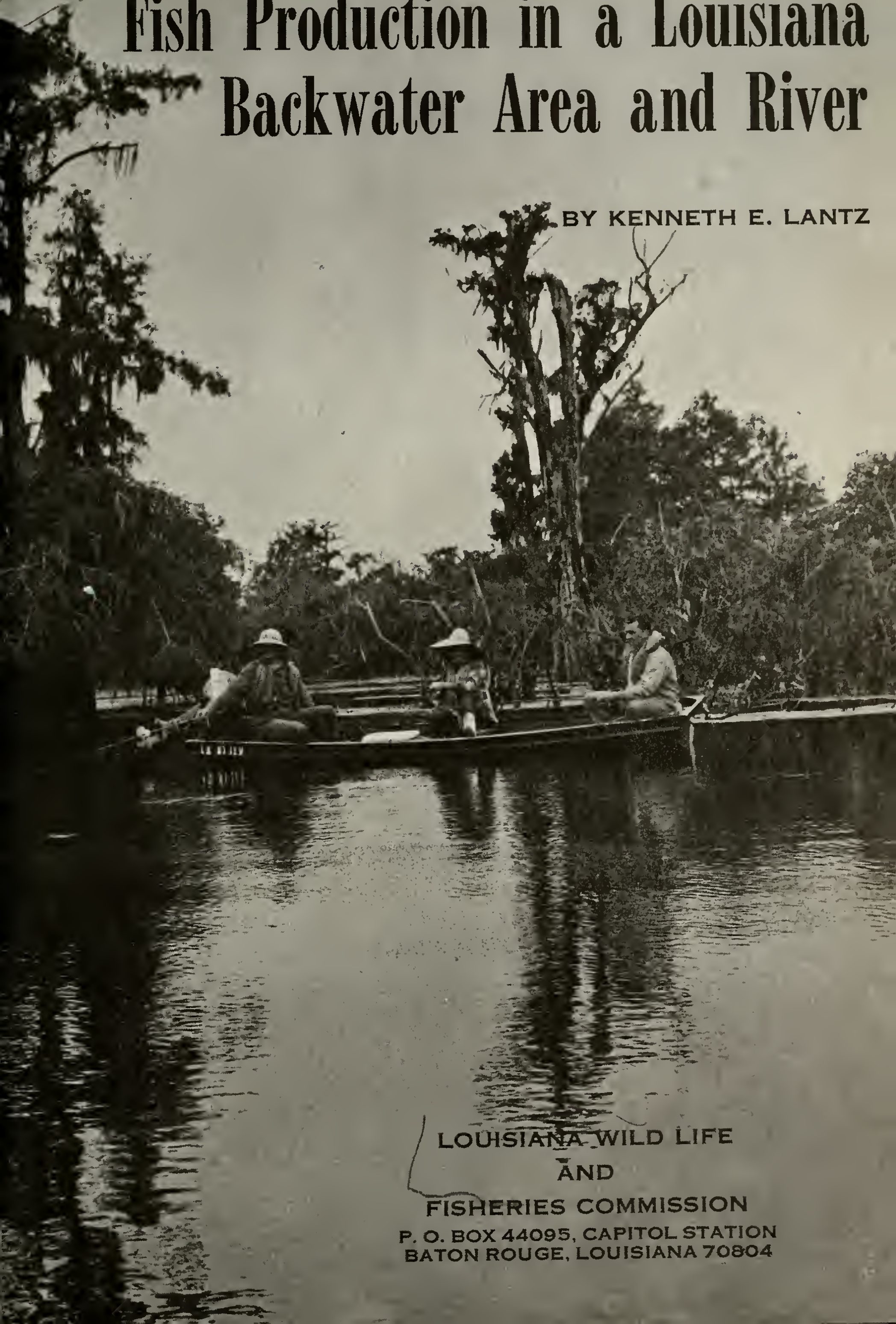
An Ecological Survey of Factors Affecting

Fish Production in a Louisiana Backwater Area and River

BY KENNETH E. LANTZ



LOUISIANA WILD LIFE
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An Ecological Survey of Factors Affecting Fish Production in a Louisiana Backwater Area and River

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ABSTRACT

This completion report covers the six jobs of Dingell-Johnson Project F-9-R conducted in the Amite River and Spring Bayou Backwater Area of Louisiana from July 1, 1960 through June 30, 1964. The objectives of this project were: (1) to establish what habitats are high, average or low in production of fish food organisms, (2) to determine what cycles occur in the kinds and abundance of plankton and bottom fauna and (3) to correlate these cyclic occurrences with variance in fish production in the two study areas. Thomas D. Allen, Jr. was the project leader during the first two years of the study and Kenneth E. Lantz was the leader during the latter part of the project.

Monthly measurements of physio-chemical features and plankton production in the river and backwater area are discussed. Seasonal production of bottom fauna and annual production of fish are presented along with data indicating seasonal utilization of available benthos and plankton by fish in each study area.

Dissolved oxygen, free carbon dioxide, pH and total phosphate monthly values between upstream and downstream regions of the Amite River were correlated with monthly stream flow changes. Increases in alkalinity and total phosphate values in the Spring Bayou Area were associated with late spring backwater flooding from the Red River. Reduction in the annual occurrence and degree of backwater flooding since 1954 has caused reduced spring turbidities and water fluctuations in the Spring Bayou Area, resulting in the establishment and spread of submerged vegetation throughout the area.

Seasonal bottom fauna counts and weights were maximal in winter and minimal in late spring and early summer in both study areas. Trends in the Amite River bottom fauna correlated with changes in seasonal stream flows.

Summer fish population samples from the Spring Bayou Area indicate this series of shallow lakes is supporting one of Louisiana's highest standing crop of total and available

size fish. The desirable predator-prey ratios of fish found in this area are outstanding, although there has been a reduced occurrence of backwater flooding during the past ten years. Low standing crop values and poor predator-prey ratios in the Amite River are similar to values reported in infertile lotic areas of western Louisiana.

Seasonal utilization of fish foods indicate Chironomidae and Chaoborinae were major food items in summer diets of bluegill, redear sunfish and black crappie in the Spring Bayou Area. There was a seasonal shift in feeding to nonbenthic Amphipoda in winter collections of bluegill and crappie. Stomach samples from the Amite River were too few in number to indicate any seasonal trends in feeding.

An Ecological Survey of Factors Affecting Fish Production in a Louisiana Backwater Area and River[1]

KENNETH E. LANTZ[2]

INTRODUCTION

This study was initiated in July, 1960 as an ecological survey of physical, chemical, and biological factors affecting fish production in a Louisiana river and a backwater area. It included a four year evaluation of physical and chemical characteristics, plankton, benthos, and fish populations in the Amite River and the Spring Bayou Backwater Area of Louisiana (Figure 1).

The Amite River has its headwaters in southeastern Mississippi and flows in a southerly and southeasterly direction for a distance of 170 miles to the western side of Lake Maurepas in southeastern Louisiana (Figure 2). The river drains an area of approximately 2,000 square miles of predominately rolling hill lands of Pleistocene age except a relatively small area of 200 square miles of recent alluvial flood plain of the Mississippi River. The drainage area of the stream ranges in elevation from 400 feet at its headwaters to sea level near its entrance into Lake Maurepas. The river drains predominately second growth pinelands except the lower section which meanders through a hardwood swamp. The principal tributaries are the Comite River, Bayou Manchac and Colyell Bay.

The rapid runoff from the uplands often produces flood stages in the flat flood plain of the lower Amite River and causes damaging backwater flooding in Bayou Manchac and the Comite River. Construction was begun by the United States Army Corps of Engineers in June, 1957 to direct excess flood flow from the lower Amite River to Blind River. The construction included creation of a 10.6 mile channel

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[1] Contribution from Dingell-Johnson Project F-9-R, Louisiana.

[2] Fisheries Biologist, Louisiana Wild Life and Fisheries Commission.

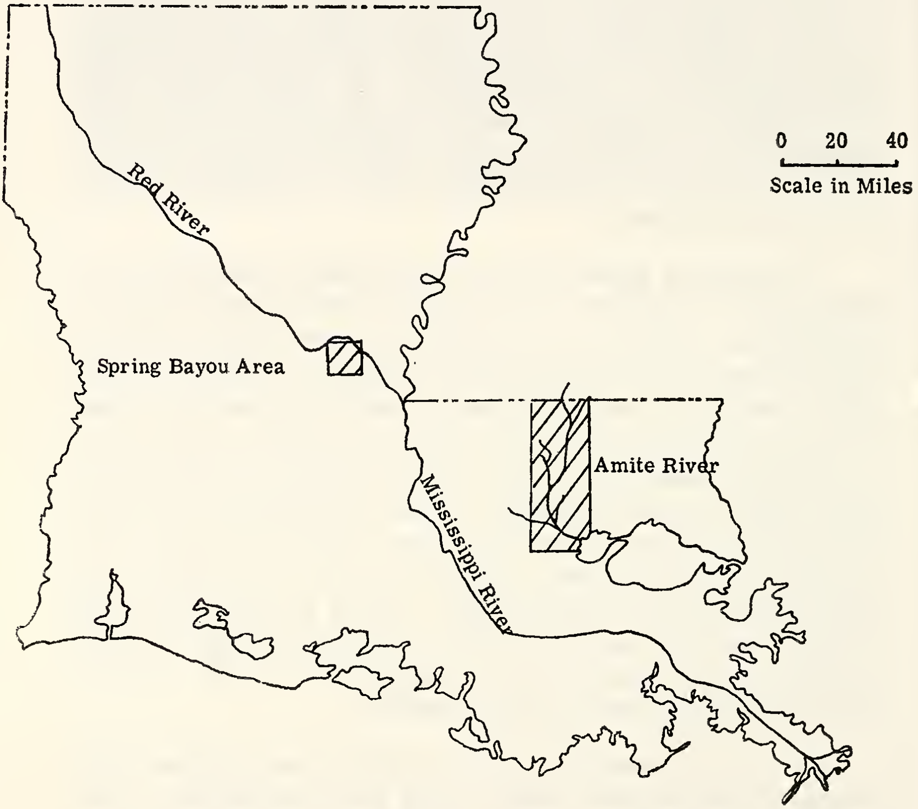

Figure 1. Map of Louisiana showing study areas.

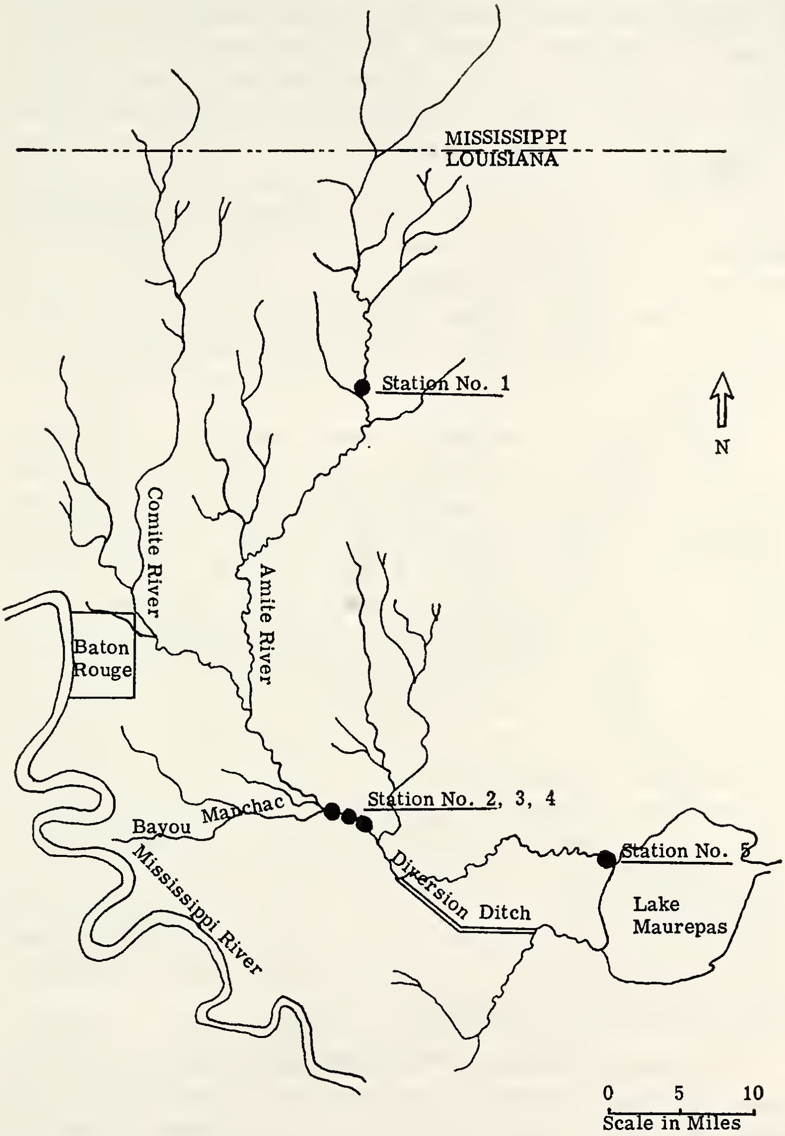

Figure 2. Amite River showing sampling stations.

from French Settlement to Blind River, enlargement and realignment of the Amite from Bayou Manchac to French Settlement and intermittent clearing of trees and stumps in the Amite from the Comite River to Bayou Manchac (U.S. Corps of Engineers, 1956). This construction was completed in November, 1963 during the latter part of the study. Selection of field stations for this study were made to evaluate present and future influence of these flood control practices on the ecology of the Amite. Station 1 (Figure 2) was at Grangeville, upstream from the construction; stations 2-4 were located near Port Vincent in the area of channel alignment and enlargement, station 5 was at the mouth of the Amite River, downstream from the diversion channel. In the discussion, these river areas will be designated upper, middle and lower stations, respectively.

Spring Bayou Backwater Area is made up of a system of shallow lakes in central Louisiana formed by the fluvial action of the Red River and is subject to periodic backwater flooding from this river by way of Bayou Natchitoches (Figure 3). During spring flooding in Red River, water backs up Bayou Natchitoches into Bayou Jeansonne and over Little River Dam and enters the Spring Bayou Area by way of Bayou Bourbie. Approximately 6400 acres of this recent alluvial soil are covered for varying lengths of time, depending on the extent of high water in the Red, Atchafalaya and Mississippi Rivers. Following recession of flood waters, the area had a low water pool of approximately 1500 acres of shallow lakes and interconnecting channels. Low water depths ranging between three and five feet are maintained in the area by Little River Dam, a concrete structure built in 1955, following a history of numerous temporary earthen dams in the Little River-Bayou Jeansonne-Bayou Natchitoches drainage complex.

Reduced occurrence of backwaters in the Spring Bayou Area and long periods of stabilized water levels since 1954 have influenced the establishment and spread of several species of submergent plants in this shallow lake system. Fisherman access and catch success have been reduced as this vegetation spread. Recent purchase of this entire system as a public fish and hunting area (Anonymous, 1966)

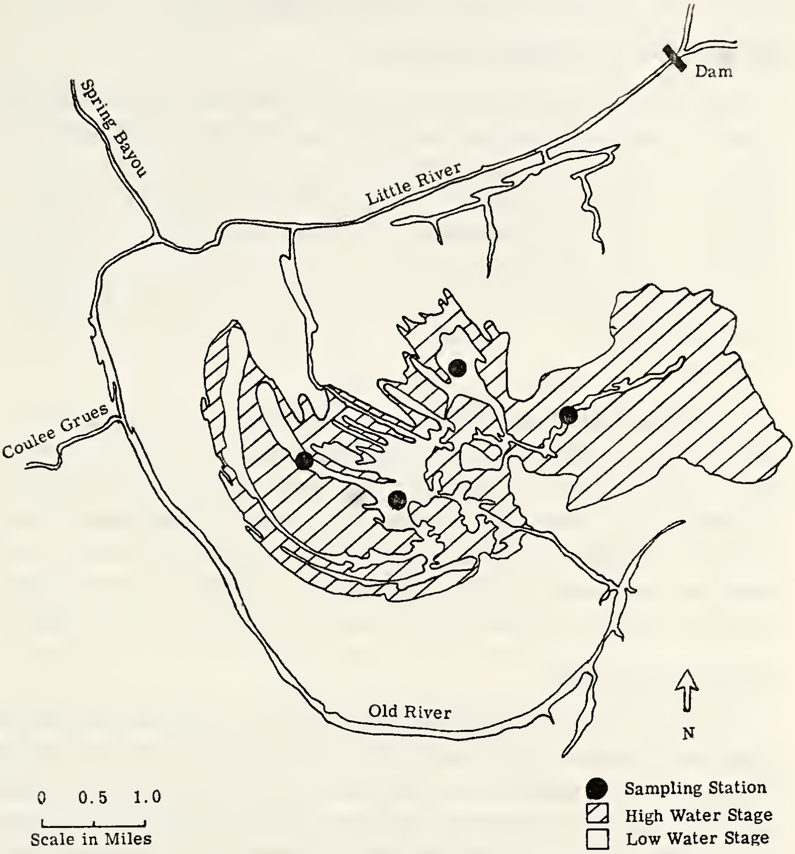

Figure 3. Spring Bayou Area showing sampling stations and extent of backwater flooding.

should permit establishment of management practices to combat the spread of this vegetation. Data collected during this study should be invaluable in future water management of this system of shallow lakes.

MATERIALS AND METHODS

Physical and Chemical Analyses

Water samples for monthly field analyses were collected in both areas with an APHA sewage sampler from a depth of three feet. Field determinations included free carbon dioxide, dissolved oxygen using the unmodified Winkler method, and carbonate-biocarbonate alkalinity methods listed by Welch (1948). A Hellige pH color comparator was used for hydrogen ion concentration and water temperatures were measured using a Whitney electrical resistance thermometer.

Samples collected monthly for laboratory analyses were taken from a depth of three feet with a portable water pump. These samples were frozen and returned to the laboratory for colorimetric determinations of total and available phosphates, organic nitrogen, ammonia nitrogen, nitrate nitrogen and nitrite nitrogen. A Bausch and Lomb Spectronic 20 colorimeter was used in these determinations.

Plankton Samples

Monthly at each station, two 20 liter net plankton samples were taken with a No. 25 bolting cloth Wisconsin style plankton net. One 20 liter sample was centrifuged and net plankton counts conducted using a Sedgwick-Rafter counting cell and a Whipple ocular micrometer. The other 20 liter sample was concentrated by centrifuge for gravimetric analysis. A one liter nannoplankton sample was collected monthly and concentrated for weighing. Gravimetric analyses for both net and nannoplankton were conducted by dehydrating the samples at 55° C for 24 hours. The dehydrated weight was recorded and the sample was then incinerated in a furnace at 600° C for 30 minutes. After cooling in a desiccator, the sample was re-weighed. The difference recorded was plankton organic material.

Bottom Fauna Collections

Quarterly benthos samples were collected at each station utilizing a Peterson dredge measuring 0.67 square feet. Four samples were taken at Spring Bayou and ten samples were collected from the Amite River. The Amite River samples included bank and channel sites and the results were averaged to give a mean station value for that period. Each sample was placed in a tub for washing and then passed through a number 30 mesh sieve. All material which remained after mild washing was preserved in 10 percent formalin and returned to the laboratory for analysis.

Hand picking and the sugar flotation method, as described by Anderson (1959), were utilized to remove organisms from the detritus. Organisms were identified, counted, weighed, volumes recorded and the results converted to units per square foot.

Fish Population and Reproduction Samples

Annual fish population samples were collected from both study areas by enclosing a one-acre area of water with a one-inch mesh webbing and pumping 1.0-1.5 ppm of five percent emulsified rotenone on and below the water surface (Lambou 1959). All fish which surfaced were collected, measured and weighed. The webbing was allowed to remain enclosing the sample area in Spring Bayou Area until the following day. Fish found floating in the enclosed area were collected and these were combined with the first day results to present a sample total. The webbing was removed from the Amite River following collection of fish which surfaced the first day. Possible damages to the webbing from entanglement by the river currents and cutting by crabs at the lower stations precluded leaving the net out until the second day. Three one-acre samples were collected from both study areas each summer and results averaged to give a mean annual standing crop of fish per acre of water.

Six 600 square feet areas in the Amite River were seined in early summer each year to determine the abundance of young fish of the year. A 30 foot nylon bobbinet minnow seine was utilized in the reproduction sampling. Due to the dense growth of submerged aquatic plants in the

Spring Bayou Backwater Area, reproduction samples could not be taken with a seine. Rotenone was applied annually to four areas of approximately 600 square feet and the young fish were collected as they surfaced.

RESULTS AND DISCUSSION

Physical and Chemical Features

Monthly water temperatures from the Spring Bayou Backwater Area and Amite River indicate no unusual thermal conditions occurred during the study. Annual maximum temperatures occurred in August and minimum temperatures occurred in January in both areas. The mean August temperature for Spring Bayou Area was 87.0° and 86.0° Fahrenheit for Amite River. The mean January temperature for Spring Bayou was 41.0° F and 50.5° F for Amite River. Monthly temperatures seldom varied more than two degrees between the upper and lower stations of the river. There was no tendency toward summer and winter thermal stratification in the backwater area as reported by Geagan and Allen (1960), Moore (1952) and Buckley and Sublette (1964) in deeper Louisiana oxbow lakes and impoundments.

Seasonal discharges (cfs) at the upper and middle stations of the Amite River are presented in Figure 4. These indicate the influence runoff from winter and spring rains had on the flow of the stream. The mean discharge of the Amite River from 1960-64 was 911.8 cfs at Darlington and 1803.2 cfs at Denham Springs (Anonymous, 1966). Seasonal breakdown of data presented in Figures 4 through 11 are Spring (March-May), Summer (June-August), Fall (September-November), and Winter (December-February).

Table 1 indicates the number of days the Red River backwater stayed in Spring Bayou Area during the study. Calculations of Red River stages at the mouth of Bayou Natchitoches were indirectly determined by averaging gauge readings of the Atchafalaya River at Barbre Landing and Black River at Acme. When the Red River at Bayou Natchitoches reached 41.0 MSL, backwater flowed over the Little River Dam and passed into Spring Bayou Area. Back-

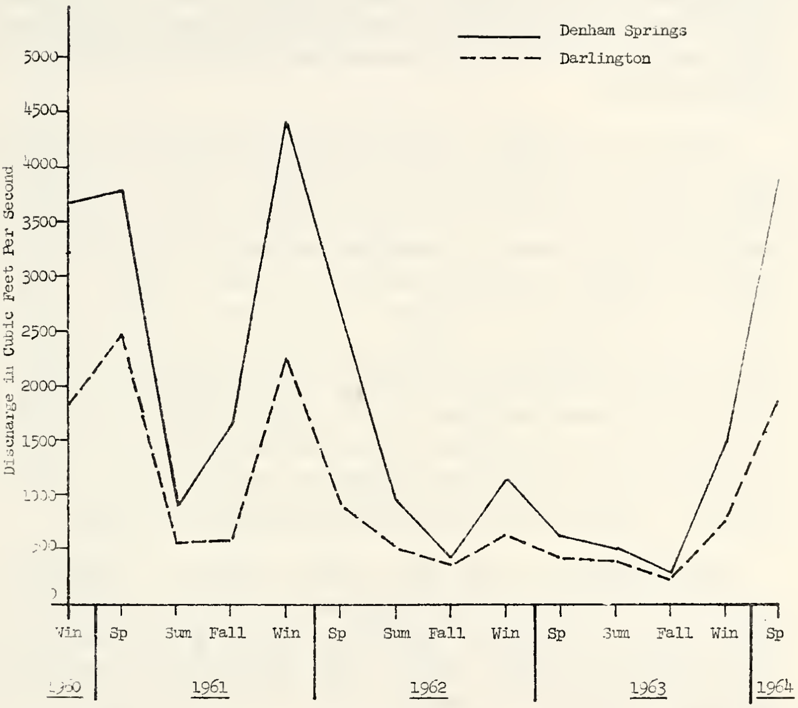

Figure 4. Mean seasonal discharge (cfs) of Amite River at Darlington and Denham Springs.

water was present in the lake system for more than two months in 1961 and 1962, but less than two weeks in 1963. Backwater did not enter the area in 1960 and 1964. There has been a reduction in the annual occurrence and degree of flooding from the Red River since 1954 (Table 1). This may be due in part to the installation of a concrete dam on Little River in 1955 at 41.0 MSL and subsequent impediment of backwaters, but is primarily due to reduced flooding in the lower Red River since 1954. Flood control practices by the United States Army Corps of Engineers in the Lower Mississippi River Valley in recent years have contributed to a reduction in the occurrence and degree of flooding in the Red River.

Dissolved oxygen determinations from the Spring Bayou Area and Amite River (Figures 5 and 6) indicate both areas had a normal tendency toward winter maximum and summer minimum values. The backwater area dissolved oxygen readings ranged between 3.1 and 9.0 ppm, with a four year average of 6.0 ppm. Amite River oxygen ranged from 4.1 to 11.0 ppm, with a four year mean of 7.0 ppm. There was a progressive decrease in oxygen between upper, middle and lower stations in the river. This is probably associated with reduced turbulence of the river downstream and increased demand on dissolved oxygen from the increase in stream biota and decaying organic matter.

Bicarbonates were the main source of alkalinity throughout the study of both areas. The river supported a lower mean bicarbonate alkalinity (23.9 ppm) than the backwater area (42.6 ppm). The Amite River seasonal alkalinity (Figure 6) ranged from 7.7 to 44.5 ppm, with low readings occurring each winter and higher readings in spring and summer. Bicarbonates ranged from 15.0 to 85.4 ppm in Spring Bayou Area, with low and high readings occuring at the same periods as in the Amite River.

Carbon dioxide and pH values varied inversely throughout the study (Figure 6). Carbon dioxide ranged between 2.0 and 18.6 ppm, with a four year mean value of 9.2 and pH ranged between 5.8 and 7.0, with a mean value of 6.5. There was a progressive increase downstream in

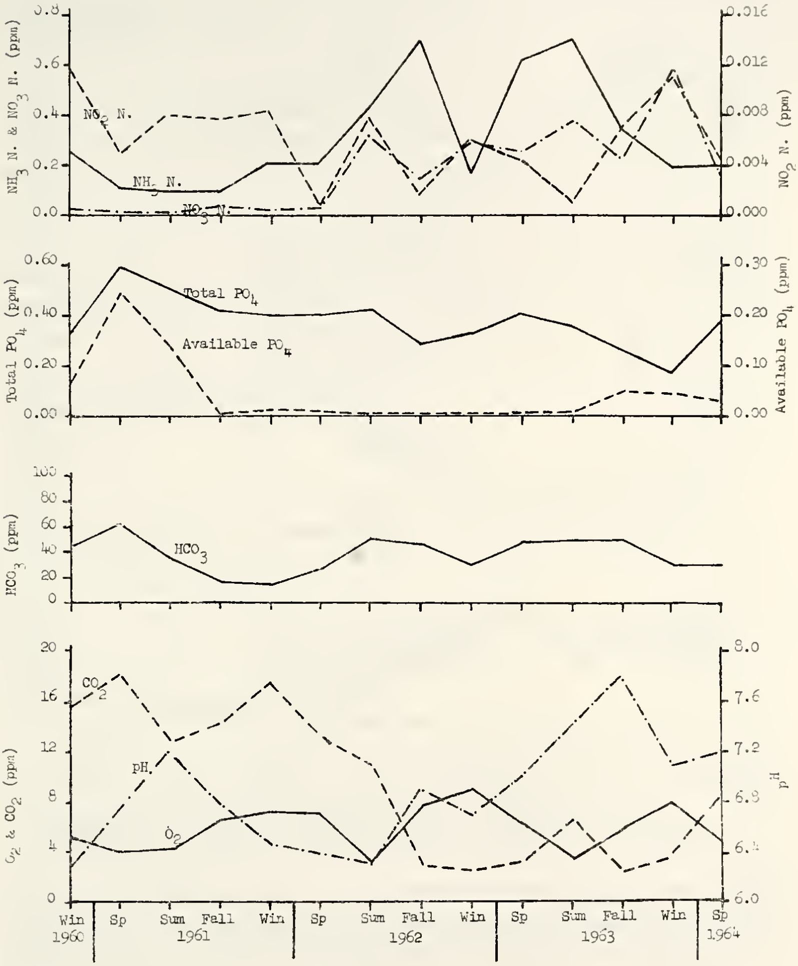

Figure 5. Seasonal variation in monthly water chemistries (ppm) from Spring Bayou backwater area.

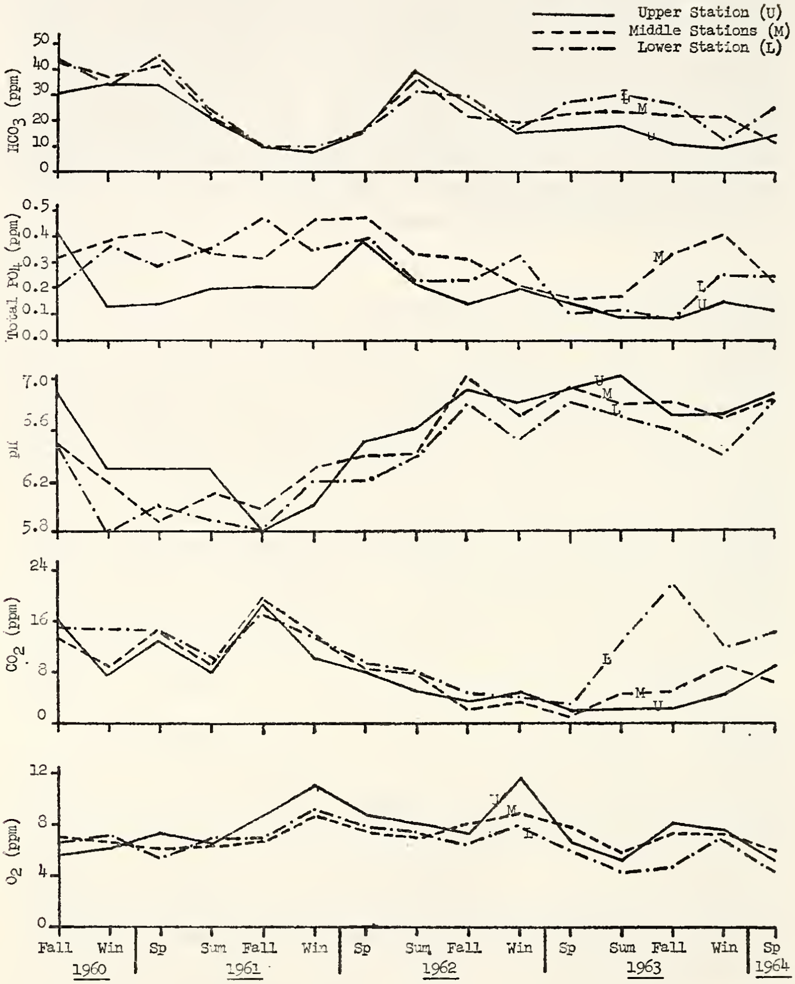

Figure 6. Seasonal variation in monthly water chemistries (ppm) from upper, middle, and lower stations of Amite River.

Table 1
ANNUAL RECORD OF BACKWATER IN SPRING BAYOU AREA[1]

Year	*Period of Backwater*	*Number of Days Water Above 41.0 MSL*[2]
1940	0	0
1941	0	0
1942	April 20–May 11	22 days
1943	June 2–June 30	29 days
1944	March 29–June 14	78 days
1945	March 6–July 19	136 days
1946	January 18–April 17	90 days
1947	April 22–May 25	34 days
1948	March 4–May 13	71 days
1949	January 30–April 28	89 days
1950	January 18–April 28	101 days
1951	February 25–April 19	54 days
1952	April 2–May 20	49 days
1953	May 10–June 10	32 days
1954	0	0
1955	April 7–April 19	13 days
1956	0	0
1957	April 29–July 15	78 days
1958	May 8–June 6	30 days
1959	0	0
1960	0	0
1961	March 21–June 10	82 days
1962	March 11-May 12	63 days
1963	April 5–April 13	9 days
1964	0	0

[1] U. S. Corps of Engineers gauge readings of Atchafalaya River at Barbre Landing and Black River at Acme used in determining period of overflow of Red River into Spring Bayou Area.

[2] Little River Dam Spillway at 41.0 MSL.

carbon dioxide and a proportional decrease in pH in samples taken monthly in the river. This is probably associated with increased primary and secondary productivity and decomposition of organic matter downstream.

Carbon dioxide and pH values did not follow any seasonal trend. The lack of a well pronounced inverse relationship between free carbon dioxide and pH seasonal values were attributed to the buffering effect of bicarbonates found in the backwater area (Figure 5). Monthly carbon dioxide values ranged from 2.8 to 17.6 ppm, with a mean of 9.8

ppm for the four year study. Monthly pH values ranged from 6.3 to 7.8, with a mean of 6.9 for the four years.

Total phosphate determinations from Spring Bayou Area (Figure 5) were high in spring and early summer and low in late fall and winter. Monthly determinations ranged from 0.001 to 0.910 ppm and the mean for the four years was 0.368 ppm. This total phosphorus mean is similar to averages from phosphate regions of Florida listed by Reid (1961) and excessive according to Moyle's (1946) classification of Minnesota lakes. Geagan and Allen (1960) found similarly high averages of total phosphates in four Louisiana lakes when using the same methods. Geagan and Allen stated that bound phosphates present in detritus during flooding may be released by the digesting procedures of these methods. Maximum total phosphate values did occur during periods of backwater in this study, while available phosphates were variable during flooding and ranged between 0.0001 and 0.3050 ppm.

Total phosphate determinations from Amite River ranged from 0.001 to 0.915 ppm. The total phosphorus mean for the four years was 0.257 ppm, which is high based on Moyle's phosphate classification. There was an increase in total phosphate from the upstream station to the lower stations each month (Figure 6).

Nitrogen analyses for the forms in which this element is found in natural waters (ammonia nitrogen, organic nitrogen, nitrate nitrogen and nitrite nitrogen) presented the most variable results of any of the chemical analyses in both areas. Figure 5 indicates the extremes of results from Spring Bayou Area. Ammonia nitrogen was the only determination that showed any prolonged trends from month to month, but these results were not seasonal. The means and ranges for the four nitrogen analyses in the backwater and river are presented in Table 2.

Results of this study indicate stream flow changes resulting from flooding and differences in gradient between upstream and downstream regions of the Amite River correlated with monthly changes in dissolved oxygen, free carbon dioxide, pH, and total phosphate values of these areas.

TABLE 2

MEANS AND EXTREMES OF NITROGEN VALUES FROM FALL 1960 TO SPRING 1964 IN BOTH STUDY AREAS

	Amite River			*Spring Bayou Area*		
Chemical Value	*Minimum*	*Maximum*	*Mean*	*Minimum*	*Maximum*	*Mean*
Ammonia Nitrogen (ppm)	0.000	1.461	0.220	0.000	0.830	0.297
Nitrate Nitrogen (ppm)	0.000	1.320	0.272	0.000	1.000	0.171
Organic Nitrogen (ppm)	0.122	5.050	1.145	0.200	3.720	0.941
Nitrite Nitrogen (ppm)	0.000	0.900	0.007	0.000	0.029	0.007

Increases in alkalinity and total phosphate values in the Spring Bayou Area were associated with late spring backwater flooding from the Red River. There has been a reduction in the annual occurrence and degree of backwater flooding in Spring Bayou Area since the mid-1950's.

Plankton

Gravimetric net and nannoplankton results from both areas were erratic throughout the study period and only nannoplankton weights from the Spring Bayou Area indicated any seasonal trend. Minimum nannoplankton weights occurred each winter and maximum nannoplankton weights occurred during the summer of 1961 and 1962 in the backwater area. Figure 7 presents a seasonal picture of the combined net and nannoplankton gravimetric results found in monthly samples from both study areas. The four year mean gravimetric total plankton for Spring Bayou was 5.0307 grams per cubic meter and 7.0545 grams per cubic meter for Amite River.

The project mean total plankton weight from Spring Bayou (5.0307 gm/m^3) is similar to that found by Geagan and Allen (1960) in Cane River Lake (5.8800 gm/m^3) and Lake Providence (4.9985 gm/m^3), two Louisiana oxbow lakes. There is doubt that the mean gravimetric total plankton value from Amite River (7.0545 gm/m^3) represents entirely plankton. During preparation of monthly samples for dehydration, the laboratory analyst often reported the winter and spring samples were a mixture of plankton, detritus and sand; although effort was made in the field as well as laboratory to sample only plankton. Maximum gravimetric results in the Amite River (Figure 7) usually occurred during flood stages (Figure 4) when the sand and silt load of the river was greatest.

The results of monthly net plankton counts from both areas are presented in Figures 8 through 11. The backwater area supported a much higher net zooplankton and phytoplankton population throughout the study than the lotic habitat of the Amite River. Rotifera and Chlorophyta were the principal zooplankton and phytoplankton groups in the net plankton counts from Spring Bayou Area. Both plank-

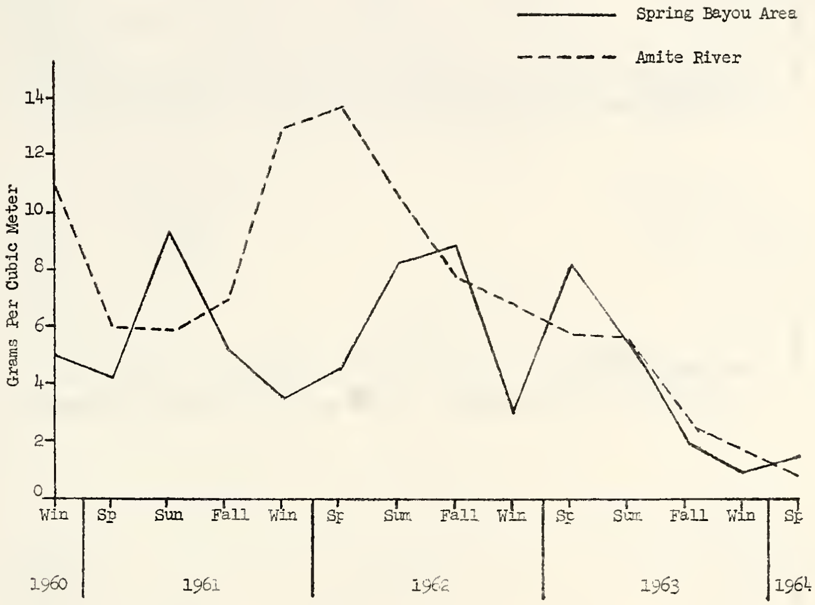

Figure 7. Comparison of mean gravimetric total plankton results (gm/m^3) from Amite River and Spring Bayou Area.

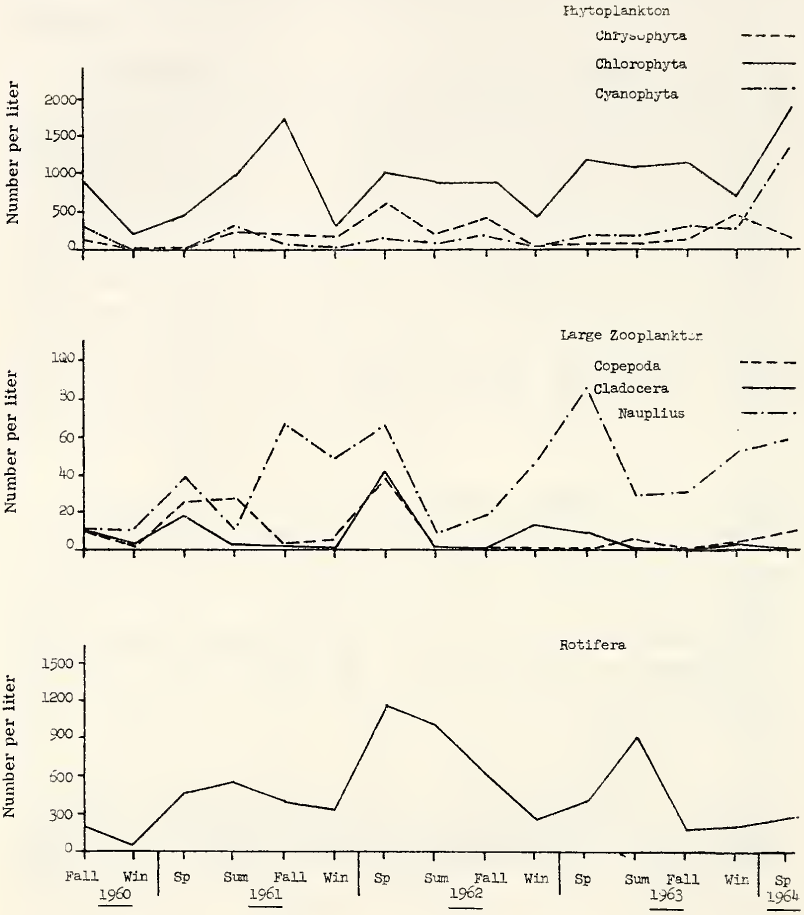

Figure 8. Seasonal variations in mean net plankton counts from Spring Bayou Area.

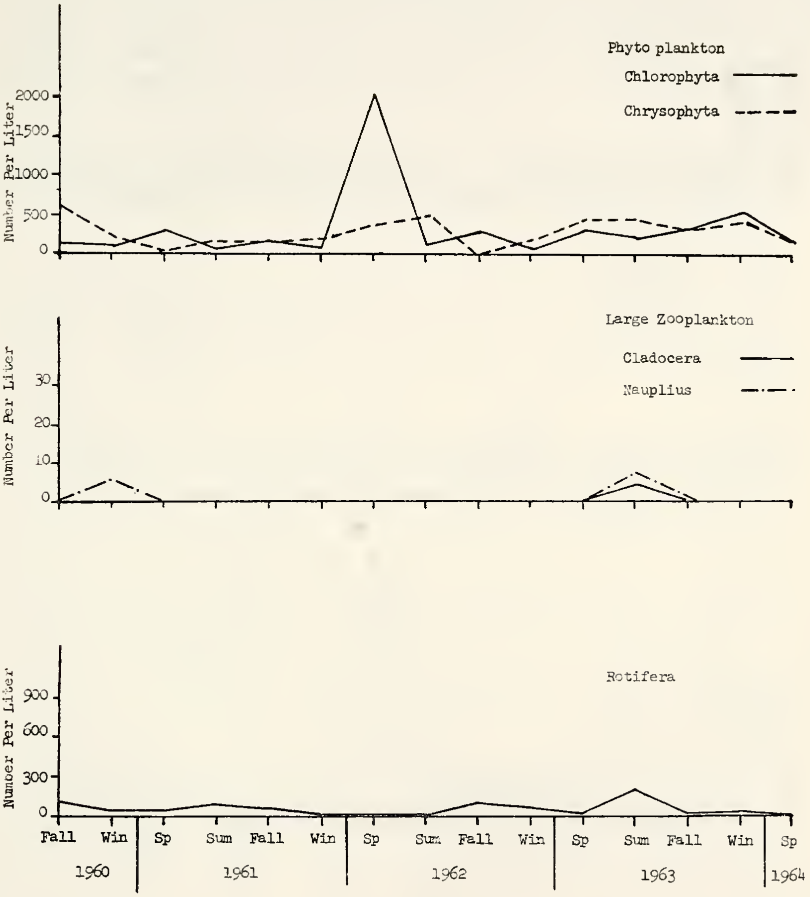

Figure 9. Seasonal variations in net plankton counts from the upper station of Amite River.

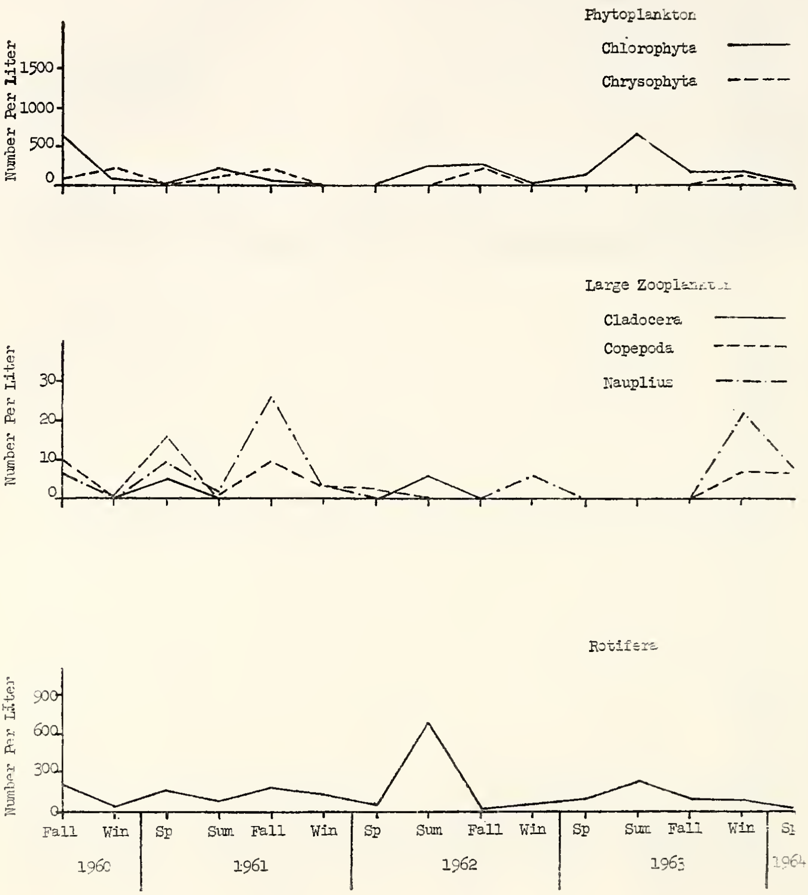

Figure 10. Seasonal variations in net plankton counts from middle stations of Amite River.

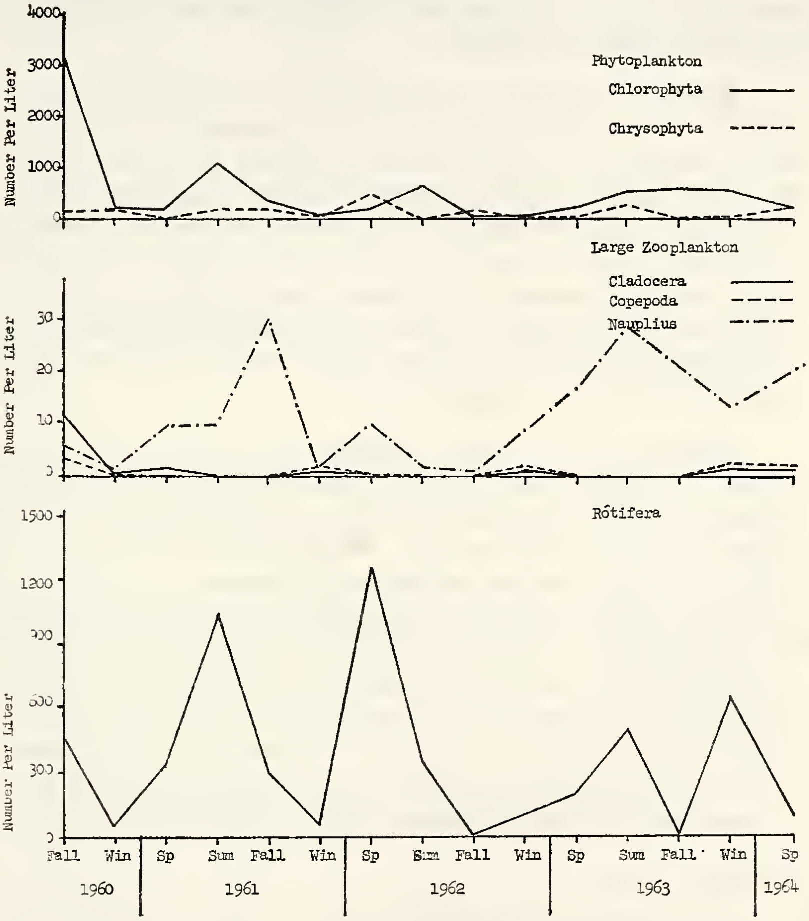

Figure 11. Seasonal variations in net plankton counts from lower station of Amite River.

ton groups showed a seasonal trend toward maximum counts in spring and summer and minimum counts in winter of each year. Cladocera and Copepoda counts were high during the spring of 1961 and 1962. Peaks in Spring Bayou Area net plankton counts and total plankton weights occurred during and following periods of backwater entering the system from Red River.

Results of plankton counts from the Amite River presented in Figures 9 through 11 show a progressive increase in net plankton from the upstream station to the lower station. The upper station supported a low net zooplankton population while the middle and lower stations exhibited a zooplankton population composed principally of Rotifera and occasional pulses of Cladocera and Copepods. Chlorophyta and Chrysophyta usually occurred in monthly net phytoplankton counts from the river, but numbers were too small to detect any seasonal trends.

Results of this study indicate the Amite River supported a definite lotic plankton population in the sections sampled, with a progressive increase in production between upper and lower stations. This longitudinal order of plankton productivity corresponded with decreases in dissolved oxygen and pH values and increases in carbon dioxide and total phosphates between upper and lower stations. Peaks in Spring Bayou Area net plankton counts and total plankton weights occurred during and following periods of backwater. This increased plankton production corresponded with maximum total phosphate and bicarbonate alkalinity values found during backwater flooding from the Red River.

Bottom Fauna

The results of seasonal benthos samples from both study areas are listed in Tables 3 through 6 and Figures 12 through 13. Identification in most cases has been to family. Tables 3 and 4 present the standing crop of benthos per square foot for each project year and the mean standing crop for the combined four years. Tubificidae were the most numerous organisms in the Amite River, making up 75.98 percent of the mean standing crop of 102.16 organisms per square foot. The major benthic groups in Spring Bayou

NUMERICAL STANDING CROP OF BENTHIC ORGANISMS PER SQUARE FOOT AS AVERAGED FROM SAMPLES COLLECTED FROM SPRING BAYOU BACKWATER AREA

Organism	*July 1960– June 1961*	*July 1961– June 1962*	*July 1962– June 1963*	*July 1963– June 1964*	*Mean*	*% of Total*
Turbellaria	0.1	...	...	...	0.02	0.03
Nematoda	0.1	0.1	...	...	0.05	0.07
Hirudinea						
Glossiphoniidae	0.1	...	0.1	3.4	0.90	1.20
Oligochaeta						
Tubificidae	28.0	11.9	0.9	27.6	17.10	22.77
Lumbriculidae	....	2.0	1.0	...	0.75	1.00
Crustacea						
Asellidae	....	...	...	0.1	0.02	0.03
Gammaridae	3.7	...	0.1	...	0.95	1.26
Talitridae	5.8	2.8	0.1	...	2.88	3.83
Insecta						
Ephemeroptera						
Ephemeridae	....	0.1	0.4	...	0.12	0.16
Baetidae	0.2	...	...	...	0.05	0.07
Odonata						
Libellulidae	0.1	...	...	0.1	0.05	0.07
Tricoptera	....	0.6	...	...	0.15	0.20
Diptera						
Chironomidae	34.6	23.8	19.2	22.7	25.07	33.38
Ceratopogonidae	2.2	1.4	1.3	2.4	1.82	2.42
Chaoborinae	47.7	30.0	11.0	7.5	24.05	32.02
Pelecypoda						
Sphaeriidae	2.9	...	0.1	0.1	0.78	1.04
Unionidae	....	0.6	...	...	0.15	0.20
Gastropoda						
Viviparidae	0.3	...	...	...	0.07	0.09
Physidae	0.2	...	...	...	0.05	0.07
Planorbidae	0.2	0.1	...	...	0.07	0.09
TOTAL	128.2	73.4	34.2	63.9	75.10	100.00

TABLE 4
NUMERICAL STANDING CROP OF BENTHIC ORGANISMS PER SQUARE FOOT AS AVERAGED FROM SAMPLES COLLECTED FROM THE AMITE RIVER

Organism	*July 1960– June 1961*	*July 1961– June 1962*	*July 1962– June 1963*	*July 1963– June 1964*	*Mean*	*% of Total*
Nematoda	....	0.2	0.3	...	0.12	0.12
Hirudinea						
Glossiphoniidae	0.2	0.3	0.4	...	0.22	0.22
Oligochaeta						
Tubificidae	88.3	146.8	11.9	63.6	77.65	75.98
Lumbriculidae	1.1	4.7	10.0	...	3.92	3.84
Arachnoidae						
Hydracarina	0.4	0.4	...	...	0.20	0.20
Crustacea						
Asellidae	0.2	...	0.1	0.1	0.10	0.10
Gammaridae	0.3	0.2	...	...	0.12	0.12
Talitridae	0.2	...	0.1	...	0.07	0.07
Insecta						
Ephemeroptera						
Ephemeridae	0.7	...	0.7	1.2	0.65	0.64
Baetidae	1.0	0.4	...	4.0	1.35	1.32
Heptageniidae	....	...	...	0.6	0.15	0.15
Odonata						
Libellulidae	....	...	...	0.9	0.22	0.22
Gomphidae	0.3	0.1	0.1	...	0.12	0.12
Plecoptera	0.4	0.2	0.7	...	0.32	0.31

Trichoptera	0.3	0.3	0.1	1.0	0.42	0.41
Coleoptera	0.2	0.2	...	...	0.10	0.10
Diptera						
Chironomidae	10.6	10.3	7.8	6.7	8.85	8.66
Ceratopogonidae	1.6	4.8	1.3	1.5	2.30	2.25
Chaoborinae	10.2	5.2	2.5	...	4.47	4.37
Tipulidae	0.2	...	...	...	0.05	0.05
Pelecypoda						
Sphaeriidae	1.2	...	0.1	0.4	0.42	0.41
Unionidae	0.5	0.1	...	...	0.15	0.15
Gastropoda						
Viviparidae	0.5	0.2	...	...	0.17	0.17
Lymnaeidae	....	...	0.1	...	0.02	0.02
TOTAL	118.4	174.4	36.2	80.0	102.16	100.00

TABLE 5

SEASONAL WEIGHTS AND VOLUMES OF BENTHIC ORGANISMS PER SQUARE FOOT FROM SPRING BAYOU AREA*

Season	*Weight (gm/ft²)*	*Volume (cc/ft²)*
Fall, 1960	0.03	0.20
Winter, 1960–61	0.68	0.76
Spring, 1961	0.22	0.30
Summer, 1961	0.23	0.37
Fall, 1961	0.45	0.42
Winter, 1961–62	0.16	0.14
Spring, 1962	0.22	0.41
Summer, 1962	0.11	0.08
Fall, 1963	0.19	0.29
Winter, 1963–64	0.15	0.44
Spring, 1964	0.03	0.08
Mean	0.22 gm/ft²	0.32 cc/ft²

*Fall, 1962—Summer, 1963 results accidently destroyed.

TABLE 6

SEASONAL WEIGHTS AND VOLUMES OF BENTHIC ORGANISMS PER SQUARE FOOT FROM AMITE RIVER*

	Organisms Excluding Mollusca		*Mollusca*	
Season	*Weight (gm/ft^2)*	*Volume (cc/ft^2)*	*Weight (gm/ft^2)*	*Volume (cc/ft^2)*
Fall, 1960	0.23	0.13	0.12	0.13
Winter, 1960–61	0.12	0.13	22.21	21.13
Spring, 1961	0.92	0.81	...	...
Summer, 1961	0.46	0.64	4.36	3.99
Fall, 1961	0.11	0.11	0.85	0.98
Winter, 1961–62	0.09	0.09	...	...
Spring, 1962	0.65	0.59	3.46	0.03
Summer, 1962	0.14	0.28	0.06	0.05
Fall, 1963	0.08	0.15	...	...
Winter, 1963–64	0.01	0.15	...	...
Spring, 1964	0.01	0.08	...	...
Mean	0.26 gm/ft^2	0.29 cc/ft^2	2.82 gm/ft^2	2.39 cc/ft^2

*Fall, 1962—Summer, 1963 results accidently destroyed.

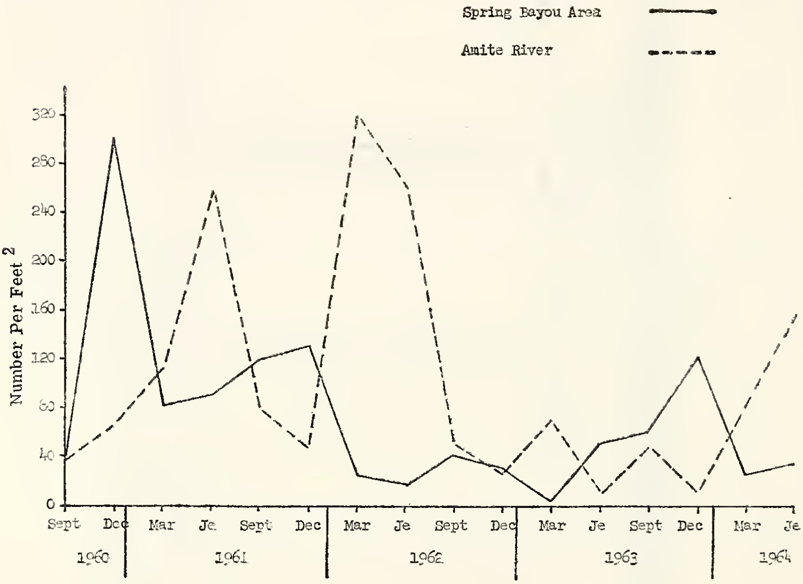

Figure 12. Comparison of mean number of benthic organisms per feet^2 from Amite River and Spring Bayou Area.

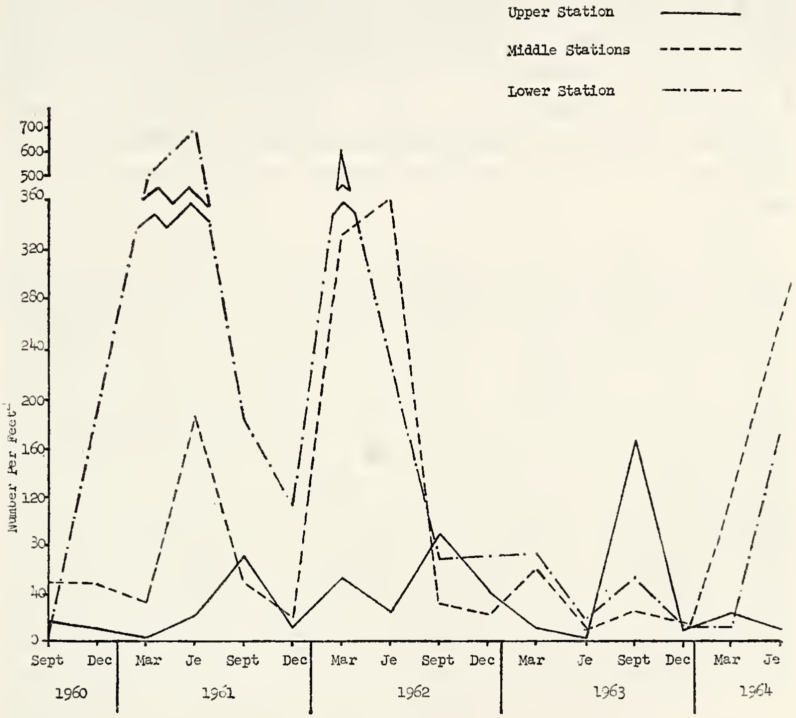

Figure 13. Comparison of mean number of benthic organisms per feet² from upper, middle, and lower stations of Amite River.

Area and major percentages of the mean standing crop of 75.10 organisms were Chironomidae (33.38 percent), Chaoborinae (32.02 percent) and Tubificidae (22.77 percent). These standing crop values represented at least twenty invertebrate groups in Spring Bayou Area and at least twenty-four groups in the Amite River.

Bottom fauna from Spring Bayou showed a seasonal trend toward winter maximum and spring minimum standing crops (Figure 13) throughout the study. The 1960, 1961 and 1963 gravimetric and volumetric results in Table 5 also followed the same seasonal variation. Extent of high and low numbers of organisms varied from year to year (Figure 12) during this four-year study of Spring Bayou Area.

The Amite River seasonal standing crop values presented in Figure 13 are reversed from that found in Spring Bayou Area. Maximum numbers occurred in late spring and summer and minimum numbers occurred in winter. Gravimetric and volumetric values in Table 6 followed a similar seasonal trend in this river during the first three years of the project when Mollusca were excluded from the analyses. Due to the large size of the Unionidae, only one or two individuals could affect the over all mean weights and volumes. Numerical changes and trends in bottom fauna in Amite River were more closely associated with dynamics of stream flow during the study than seasonal water temperature changes. Figure 4 indicates that peak stream discharges occurred in the winter and early spring, while high benthic populations occurred during periods of low stream discharge.

Upper, middle and lower sampling stations in the Amite River varied in major benthic groups and standing crop of organisms per square foot during each sampling period (Figure 13). The shallow upstream area (Station 1) had a gravel and sand bottom that supported a typical riffle population of mostly Diptera and Ephemeroptera. The middle areas (Stations 2-4) were in a sand and clay bottom type where the stream depth was 15-20 feet deep. The downstream area (Station 5) was at the mouth of the Amite River near its entrance into Lake Maurepas where the bottom type was muck, silt and detritus and water depth was 18-25 feet. The major benthic groups found at the middle and lower stations were Oligochaeta and Diptera. The annual numerical standing crops of benthic organisms as averaged from all samples collected from the Amite River (Table 4) showed the influence of large numbers of Oligochaeta and Diptera in the middle and lower stations. The four year mean standing crop of benthic organisms at the upper station was 34.73 individuals per square foot, 102.82 per square foot at the middle stations and 181.48 per square foot at the lower stations.

It is possible that more frequent sampling of the benthos in both study areas (monthly rather than quarterly) would have presented a better picture of this habitat in the stream and backwater lake. Short life histories, predation, and other natural forces often produce rapid changes in invertebrate bottom fauna. The design of this job was not intended to present a detailed survey of this habitat, but to establish the qualities and quantities of bottom fauna in the two areas. The results of this study indicate there was a progressive increase in production of benthic organisms from upper to lower regions of the Amite River. Numerical, gravimetric, and volumetric measurements of bottom fauna in the Amite were maximum in winter and minimum in late spring and summer. Changes and trends in the Amite bottom fauna corresponded with peak and low flow records of the stream. Bottom fauna in Spring Bayou Area showed a seasonal trend toward winter maximum and spring minimum counts, weights and volumes.

Fish Populations

The results of annual fish population samples are presented in Tables 7 and 8 according to the methods suggested by Surber (1959). The annual summer standing crop values for Spring Bayou Backwater Area ranged from 301 to 469 pounds per acre with a mean three year value of 362 pounds. The Amite River yielded a much lower range of 19 to 48 pounds per acre and a mean three year value of only 38 pounds.

Standing crop values from Spring Bayou Area were

Table 7

MEAN STANDING CROP IN POUNDS OF FISH PER ACRE FROM THREE ONE-ACRE ROTENONE SAMPLES* COLLECTED ANNUALLY FROM SPRING BAYOU BACKWATER AREA

	Available Size			*Intermediate Size*			*Fingerling Size*		
Species	*1962*	*1963*	*1964*	*1962*	*1963*	*1964*	*1962*	*1963*	*1964*
Predatory Game Fish									
Largemouth bass	13.3	14.6	9.5	3.1	...	...	0.4	..	Tr.
Yellow bass	0.1	....	....	...	...	0.1	..	..	..
White crappie	1.0	....	....	0.2	...	0.1	..	..	0.1
Black crappie	39.4	12.8	9.1	2.8	1.3	0.2	0.1	..	0.1
Chain pickerel	1.3	2.2	3.1	...	...	...	..	..	..
TOTAL	55.1	29.6	21.7	6.1	1.3	0.4	0.5	0.0	0.2
Non-Predatory Game Fish									
Bluegill	132.8	61.6	27.5	23.7	0.1	1.8	0.3	..	0.1
Orangespotted sunfish	1.9	....	....	0.6	...	...	0.1	..	..
Redear sunfish	29.0	24.3	22.1	4.8	...	0.2	..	..	..
Warmouth	12.7	7.3	2.6	2.2	...	0.5	..	..	Tr.
TOTAL	176.4	93.2	52.2	31.3	0.1	2.5	0.4	0.0	0.1
Non-Predatory Food Fish									
Freshwater drum	8.4	17.2	1.5	...	...	0.3	..	..	..
Bigmouth buffalo	34.0	15.0	38.2	0.5	17.0	12.6	..	..	..
Lake chubsucker	0.3	....	....	...	...	...	..	..	..
Yellow bullhead	0.8	1.8	....	...	...	...	..	..	..
Brown bullhead	....	1.2	....	...	...	...	..	..	..
Carp	....	....	....	0.7	...	...	..	..	..
TOTAL	43.5	35.2	39.7	1.2	17.0	12.9	0.0	0.0	0.0

Predatory Food Fish								
Channel catfish	3.0	0.6	1.3	0.6	...	0.4	..	..	..
Spotted gar	10.0	15.2	25.6	3.7	2.2	2.3	..	..	..
Shortnose gar	....	....	0.8	0.2	...	...	..	..	..
Bowfin	3.1	7.0	0.6	...	...	...	..	..	..
TOTAL	16.1	22.8	28.3	4.5	2.2	2.7	0.0	0.0	0.0
Forage Fish									
Gizzard shad	94.4	73.6	92.7	38.6	41.4	47.5	0.7	..	..
Threadfin shad	....	....	....	...	...	...	..	..	0.2
TOTAL	94.4	73.6	92.7	38.6	41.4	47.5	0.7	0.0	0.2
GRAND TOTAL	385.5	254.4	234.6	81.7	62.0	66.0	1.6	0.0	0.5

	1962	*1963*	*1964*	*Mean*
Standing Crop/Acre	468.8	316.4	301.1	362.1

* 1962 data averaged from six one-acre samples.

TABLE 8

MEAN STANDING CROP IN POUNDS OF FISH PER ACRE FROM THREE ONE-ACRE ROTENONE SAMPLES COLLECTED ANNUALLY FROM AMITE RIVER

	Available Size			*Intermediate Size*			*Fingerling Size*		
Species	*1962*	*1963*	*1964*	*1962*	*1963*	*1964*	*1962*	*1963*	*1964*
Predatory Game Fish									
Largemouth bass	3.5	0.2	0.6	0.7	...	0.2	Tr.	..	0.1
Spotted bass	....	....	....	...	...	...	Tr.	0.1	..
Yellow bass	0.1	0.2	....	0.1	0.7	0.8	..	..	..
White crappie	0.7	0.3	1.7	0.1	...	0.1	..	..	0.1
Black crappie	0.1	0.1	....	0.4	...	0.1	..	..	..
TOTAL	4.4	0.8	2.3	1.3	0.7	1.2	Tr.	0.1	0.2
Non-Predatory Game Fish									
Bluegill	1.1	0.1	0.8	1.1	...	0.9	Tr.	..	..
Redear sunfish	0.4	....	1.4	...	...	1.3	Tr.	..	0.1
Warmouth	1.0	Tr.	0.1	0.1	Tr.	0.5	..	..	..
TOTAL	2.5	0.1	2.3	1.2	Tr.	2.7	Tr.	0.0	0.1
Non-Predatory Food Fish									
Freshwater drum	4.7	0.4	3.3	1.1	0.2	...	Tr.	..	2.6
Smallmouth buffalo	2.7	....	2.1	...	...	...	..	..	..
Striped mullet	....	0.2	0.8	...	0.1	1.3	..	..	..
American eel	0.4	....	0.2	...	...	...	..	..	..
TOTAL	7.8	0.6	6.4	1.1	0.3	1.3	Tr.	0.0	2.6

Predatory Food Fish									
Channel catfish	0.5	2.6	3.4	0.3	1.5	2.8	..	0.8	..
Blue catfish	15.1	....	3.1	0.2	...	0.3	..	..	..
Flathead catfish	2.6	....	....	...	...	...	..	..	..
Spotted gar	3.3	....	9.5	1.4	...	...	..	..	..
Bowfin	2.9	....	....	...	...	...	..	..	..
TOTAL	24.4	2.6	16.0	1.9	1.5	3.1	0.0	0.8	0.0
Forage Fish									
Gizzard shad	1.4	7.5	8.1	0.7	...	...	0.2	..	0.6
Threadfin shad	....	....	....	...	...	...	0.2	..	..
Menhaden	....	....	....	...	...	...	..	1.3	Tr.
Bay anchovy	....	....	....	...	...	...	..	2.3	..
TOTAL	1.4	7.5	8.1	0.7	0.0	0.0	0.4	3.6	0.6
GRAND TOTAL	40.5	11.6	35.1	6.2	2.5	8.3	0.8	4.5	3.5
	1962	*1963*	*1964*	*Mean*					
Standing Crop/Acre	47.5	18.6	46.9	37.7					

similar to those found by Lambou (1959), although somewhat lower than his mean value of 651 pounds determined from four one-acre samples from this backwater area in 1954. Lambou indicated large concentrations of fish sometimes occur in relatively small areas in backwater areas, as was represented by 974 pounds from one of his 1954 Spring Bayou Area stamples. The results of the other three 1954 samples were 358, 477 and 794 pounds per acre, which fall more in the range of 301 to 469 pounds found in Spring Bayou Area during this study (Table 7).

Standing crop values from the Amite River were obtained from first day pick up data and probably do not represent the total fish that existed in the blocked off area. These annual samples (Table 8) were consistently low in total poundage, each year. Geagan (1960), Lantz (1962) and Lantz et al. (1967) in sampling streams and impoundments in similar infertile drainages of central Louisiana found summer standing crop values ranging from 22 to 60 pounds per acre. Lambou (1959) found Colyell Bay, a backwater area of the Amite River, had the lowest standing crop of fish in Louisiana backwater areas. Colyell Bay had a standing crop of 142 pounds while the mean value of all Louisiana backwater areas was 397 pounds per acre.

The mean standing crop of available game fish was high in the Spring Bayou Backwater Area (142.7 pounds) and low in the Amite River (4.1 pounds). These represent 39.4 and 10.9 percent of the mean standing crop of fish from the two areas, respectively. Available size bluegill, redear sunfish, black crappie and largemouth bass were abundant in the Spring Bayou Area with mean standing crops of 74, 25, 21 and 13 pounds respectively. Largemouth bass and white crappie were the principal available size game fish found in the Amite River with mean standing crops of 1.8 and 1.0 pounds. The high percent of available size game fish in Spring Bayou Area is similar to that found by Lambou in 1954. Lambou indicated that 91.2 percent of the total poundage of game fish consisted of available size fish, while results of this study produced a similar value of 91.9 percent. Lambou stated there is a larger percentage of the standing crop of game fish consisting of available size fish in backwater lakes than in any other type of freshwater area in Louisiana.

The mean predator-prey relationship from Spring Bayou Area, utilizing the method described by Lambou (1959), was 1:4.7 for the three summer samples. This ratio was close to the 1:4.8 found by Lambou in his study of the Spring Bayou Area in 1954. The 4.7 pounds of non-predaceous fish per pound of predaceous fish falls within the desirable F/C ratio range of 3.0 to 6.0 Swingle (1950) found in balanced fish populations in Alabama. Swingle defined F/C as the ratio of the total weight of all forage fish to the total weight of all carnivorous fish in a population. The mean predator-prey relationship from the Amite River was 1:0.8 which would be considered undesirable according to Swingle's F/C range for balanced population.

Further analysis of standing crop values from the two areas to give a relationship between the weights of predator and prey species of fish is termed Y/C. If Y/C as described by Swingle (1950) is calculated by substituting the weight of fish under five inches as Y instead of determining the size fish which could be eaten by adult predators, the ratios from both areas are 0.2. Swingle (1950) described the desired ratio to be between 1.0 and 3.0. Lambou (1959) also found a Y/C value of 0.2 in Spring Bayou Area. He stated it was doubtful that predaceous fish in backwater areas could support themselves on considerably less available forage (by weight) than they themselves made up in the population. Lambou suggested other aquatic organisms such as macrocrustaceans may serve as forage in backwater areas. A later study by Lambou (1961) revealed the swamp crawfish, *Procambarus clarki,* made up over 50 percent of the diet of largemouth bass collected in the spring and summer of 1958 and 1959 from the backwaters of the Atchafalaya River. Crawfish did not occur in fish stomachs collected in Spring Bayou Area during this study, but grass shrimp (*Palaemonetes* sp.) were sometimes found in large quantities in largemouth bass stomachs (Table 10).

Results of annual fish collections from Spring Bayou Area do not support recent reports of a decline in fishing success in this backwater system. High standing crop values of total fish, available game fish, and desirable predator-prey ratios each summer indicate this area is maintaining one of the highest fish populations in Louisiana, even though there has been a reduction in the occurrence and extant of backwaters since 1954. The F/C and Y/C values found during this study were very similar to those found by Lambou in 1954.

If there has been a decline in fishing success in Spring Bayou Area in recent years. it is probably associated with increased growth and spread of submergent vegetation and subsequently reduced access rather than with changes in fish population dynamics. There is not a documented record of changes in this aquatic vegetation in the area since 1954, however sportsmen remarks and reduced periods of backwater (Table 1) give indirect evidence that the submergents have increased in recent years.

Young of the year fish samples taken each summer in the backwater area and river were variable from year to year (Table 9). Good spawns of largemouth bass in 1961 and 1962 and white crappie in 1961 in Spring Bayou Area occurred during years of maximum backwater. Bluegill sunfish showed good spawning success in 1962 and 1963 in the backwater area. Spotted bass and black crappie spawned well in 1961 in the Amite River while bluegill and longear sunfish were more successful in 1962 and 1963. In general, it can be said that most important game fish species (except yellow bass in the Amite River) showed signs of successful spawning in both areas during this study. The lack of spawning of yellow bass and low standing crop of this fish, support reports of reduced annual runs of this species in recent years in the Amite River.

Utilization of Fish Foods

Food items found in stomachs of five important game fish species collected in the two study areas are presented in Tables 10 through 14. Trammel nets and sports fishing gear were used in collection of bluegill, redear sunfish, black crappie, largemouth bass and yellow bass in an effort to evaluate utilization of plankton and benthic organisms.

TABLE 9

NUMBER OF YOUNG OF THE YEAR FISH AS AVERAGED FROM SIX-600 FT.^{2} SUMMER SAMPLES

	Spring Bayou Area			*Amite River*		
Species	*1961*	*1962*	*1963*	*1961*	*1962*	*1963*
Largemouth bass	16	14	5	1	4	2
Spotted bass	...	...	...	27	6	3
White crappie	60	6	35	..	..	..
Black crappie	...	...	...	58	3	..
Bluegill	36	286	690	2	33	77
Redear sunfish	5	91	3	..	..	..
Longear sunfish	...	...	...	1	31	15
Warmouth	14	49	5	..	..	..
TOTAL	131	446	738	89	77	97

TABLE 10
COMPARISON OF FOOD ITEMS IN STOMACHS OF BLUEGILL FROM SPRING BAYOU BACKWATER AREA

	Summer 1961 (142 stomachs)			*Winter 1961 (101 stomachs)*			*Summer 1962 (46 stomachs)*			*Summer 1963 (28 stomachs)*		
Organism	*Frequency*	*Total No.*	*Percent of Total Contents*	*Frequency*	*Total No.*	*Percent of Total Contents*	*Frequency*	*Total No.*	*Percent of Total Contents*	*Frequency*	*Total No.*	*Percent of Total Contents*
Oligochaeta												
Tubificidae	4	7	0.1									
Arachnoidae												
Hydracarnia	19	282	3.7									
Crustacea												
Ostracoda	21	261	3.4	1	218	7.2	2	3	0.3			
Cladocera	14	1869	24.4	...	....	....	..	...	...			
Copepoda	13	91	1.2	...	....	....	3	25	2.5			
Amphipoda	11	146	1.9	46	1263	41.7	4	10	1.0			
Palaemonidae	..	....	....	5	6	0.2	2	2	0.2			
Odonata	..	....	....	35	240	7.8	..	...	...	10	39	13.2
Trichoptera	..	....	....	33	899	29.7	..	...	...			
Diptera												
Chironomidae	109	4747	61.9	37	395	13.0	30	923	93.1	11	250	84.4
Certopoginidae	17	33	0.4	1	1	0.1	4	7	0.7	..	...	...
Chaoborinae	25	230	3.0	2	9	0.3	1	18	1.8	2	3	1.0
Coleoptera	2	3	0.1				1	1	0.1	4	4	1.3
Pisces	..	....	....	...	....	....	2	2	0.2	..	...	...
TOTAL	235	7669	100.0	160	3031	100.0	49	991	99.9	27	296	99.9

Aquatic insects were of major significance in the diets of bluegill, redear sunfish, and black crappie collected in the summers from 1961 through 1963 in Spring Bayou Area (Tables 10-12). This was the time of the year when benthic organisms were minimal in numbers in this area (Figure 12). Chironomidae was the main summer food item of bluegill, making up 62 percent of the total number of stomach items in 1961, 93 percent in 1962 and 84 percent in 1963. During the summer of 1961, bluegill stomachs contained large numbers of Cladocera (25 percent of the total stomach items). Redear sunfish summer diets were made up of chironomids in 1961 (76 percent of total food items), 1962 (82 percent) and 1963 (95 percent). Use was also made of Chaoborinae by this species in 1961 (12 percent) and 1962 (14 percent of the food items). Black crappie, an important predatory game fish species in Spring Bayou Area, also preferred Diptera during the summer months. Stomach contents of black crappie in the summer of 1961 were mostly of Chironomidae (46 percent of total stomach items) and Chaoborinae (39 percent). In the summer of 1962, Chironomidae and Chaoborinae represented 52 percent and 36 percent of all items found in the stomachs of this game fish species.

Stomach samples collected during the winter of 1961 in Spring Bayou Area indicate there was a seasonal shift in main food items of bluegill and black crappie. Amphipoda, a macrocrustacean usually found in mats of submerged vegetation, made up 42 percent of the food items in bluegill stomachs and 66 percent of the stomach contents in black crappie (Tables 10 and 12). This seasonal shift in preference to non-benthic organisms occurred when benthic organisms were maximal in numbers in bottom fauna samples (Figure 12). Redear sunfish continued to use benthic organisms with chironomids making up 74 percent of the food items eaten in winter of 1961 (Table 11).

Presence of large numbers of amphipods in winter stomach samples of bluegill and black crappie (Table 10 and 12) and the occurrence of Palaemonidae in stomach contents of largemouth bass (Table 13) collected from Spring Bayou Area indicate inadequate sampling of an

TABLE 11

COMPARISON OF FOOD ITEMS IN STOMACHS OF REDEAR SUNFISH FROM SPRING BAYOU BACKWATER AREA

Organism	*Summer 1961 (88 stomachs)*			*Winter 1961 (63 stomachs)*			*Summer 1962 (51 stomachs)*			*Summer 1963 (43 stomachs)*		
	Frequency	*Total No.*	*Percent of Total Contents*	*Frequency*	*Total No.*	*Percent of Total Contents*	*Frequency*	*Total No.*	*Percent of Total Contents*	*Frequency*	*Total No.*	*Percent of Total Contents*
Oligochaeta												
Tubificidae	2	5	0.2									
Crustacea												
Cladocera	2	201	7.1									
Copepoda	10	50	1.8				7	13	0.6			
Amphipoda	2	18	0.6	5	10	0.9	..	....	....			
Odonata	..	....	...	8	30	2.9	..	....	....	12	44	2.0
Diptera												
Chironomidae	46	2184	77.5	19	752	73.8	38	1877	82.1	32	2081	95.3
Ceratopogonidae	8	10	0.4	2	10	0.9	11	74	3.2	5	11	0.5
Chaoborinae	27	349	12.4	2	15	1.6	22	322	14.1	14	48	2.2
Pelecypoda	2	2	0.2	6	202	19.8	..	....	....	..	....	....
TOTAL	99	2819	99.9	42	1019	99.9	78	2286	100.0	63	2184	100.0

TABLE 12

COMPARISON OF FOOD ITEMS IN STOMACHS OF BLACK CRAPPIE FROM SPRING BAYOU BACKWATER AREA

	Summer 1961 (21 stomachs)			*Winter 1961 (70 stomachs)*			*Summer 1960 (14 stomachs)*		
Organism	*Frequency*	*Total No.*	*Percent of Total Contents*	*Frequency*	*Total No.*	*Percent of Total Contents*	*Frequency*	*Total No.*	*Percent of Total Contents*
Crustacea									
Cladocera	2	6	0.3						
Copepoda	1	13	0.8				3	6	2.0
Amphipoda	1	28	1.6	27	1457	65.6	4	21	7.0
Palaemonidae	..	....	....	30	110	5.0	1	2	0.7
Arachnoidae									
Hydracarnia	5	113	6.6	...	....	....	1	1	0.3
Odonata	..	....	....	18	268	12.1			
Trichoptera	..	....	....	13	82	3.7			
Diptera									
Chironomidae	9	792	46.0	10	30	1.4	6	154	51.7
Ceratopogonidae	6	87	5.1	2	3	0.1	..	...	....
Chaoborinae	6	669	38.9	6	248	11.1	4	106	35.6
Pisces	9	12	0.7	20	23	1.0	5	8	2.7
TOTAL	39	1720	100.0	126	2221	100.0	24	298	100.0

TABLE 13

COMPARISON OF FOOD ITEMS IN STOMACHS OF LARGEMOUTH BASS FROM SPRING BAYOU AREA AND AMITE RIVER

	Spring Bayou Area			*Spring Bayou Area*			*Amite River*			*Amite River*		
	Summer 1962 (9 stomachs)			*Summer 1963 (32 stomachs)*			*Summer 1961 (28 stomachs)*			*Summer 1962 (19 stomachs)*		
Organism	*Frequency*	*Total No.*	*Percent of Total Contents*	*Frequency*	*Total No.*	*Percent of Total Contents*	*Frequency*	*Total No.*	*Percent of Total Contents*	*Frequency*	*Total No.*	*Percent of Total Contents*
Crustacea												
Palaemonidae				17	66	75.9				1	1	1.8
Odonata				5	5	5.7				1	1	1.8
Coleoptera				1	2	2.3						
Diptera												
Chironomidae							1	3	10.7	1	22	40.7
Ceratopogonidae										1	1	1.9
Pisces	5	12	100.0	3	14	16.1	18	25	89.3	10	29	53.8
TOTAL	5	12	100.0	26	87	100.0	19	28	100.0	14	54	100.0

TABLE 14

COMPARISON OF FOOD ITEMS IN STOMACHS OF BLUEGILL, REDEAR SUNFISH AND YELLOW BASS FROM AMITE RIVER

	Bluegill Summer 1962 (24 stomachs)			*Redear Sunfish Summer 1962 (6 stomachs)*			*Yellow Bass Summer 1962 (7 stomachs)*			*Yellow Bass Summer 1963 (14 stomachs)*		
Organism	*Frequency*	*Total No.*	*Percent of Total Contents*	*Frequency*	*Total No.*	*Percent of Total Contents*	*Frequency*	*Total No.*	*Percent of Total Contents*	*Frequency*	*Total No.*	*Percent of Total Contents*
Crustacea												
Palaemonidae	2	8	5.8				1	1	1.9	8	445	74.5
Ephemeroptera	3	15	10.8							1	4	0.7
Odonata	1	1	0.7				1	1	1.9			
Trichoptera	1	2	1.4	1	1	0.9						
Diptera												
Chironomidae	10	112	80.6	1	33	98.1	1	22	41.5	1	55	9.2
Pisces	1	1	0.7				10	29	54.7	10	93	15.6
TOTAL	18	139	100.0	2	34	100.0	13	53	100.0	20	597	100.0

important segment of the food chain in this backwater area. Both of these macrocrustaceans inhabit areas of submergent vegetation found throughout this system of shallow lakes. The Peterson dredge used in sampling bottom fauna picked up few of these mobile macrocrustaceans (Table 3). Geagan and Allen (1960) also found amphipods in abundance in bluegill stomachs collected in 1958 and 1959 in Chicot Lake, a weed infested lake of central Louisiana. Lambou (1961) found macrocrustaceans were major food items in the diets of largemouth bass collected in the backwater areas of the Atchafalaya River and brackish marsh ponds along the northeastern shore of Lake Pontchartrain.

Stomach samples collected from bluegill, redear sunfish, largemouth bass and yellow bass in the Amite River are presented in Tables 13 and 14. The number of stomachs collected in this area was too small to indicate trends in feeding during the four year study. Chironomids were important in the diet of bluegill, redear sunfish, and largemouth bass examined in the summer of 1962. Grass shrimp made up 75 percent of all food items found in stomachs of yellow bass collected in the summer of 1963.

Results of this fish food study indicate Chironomidae and Chaoborinae were major food items in summer diets of bluegill, redear sunfish and black crappie in Spring Bayou Area. There was a seasonal shift in feeding to nonbenthic Amphipoda in winter collections of bluegill and black crappie. Occurrence of large numbers of amphipods in bluegill and black crappie and Palemonidae in largemouth bass indicate inadequate sampling of an important segment of the food chain in this backwater area. Stomach samples from the Amite River were too few in numbers to indicate any seasonal trends in food items.

CONCLUSIONS

1. Stream flow changes resulting from flooding and differences in gradient between upstream and dowsntream regions of the Amite River correlated with monthly changes in dissolved oxygen, free carbon dioxide, pH, and total

phosphate values of these areas. Increases in alkalinity and total phosphate values in the Spring Bayou Backwater Area were associated with late spring backwater flooding from the Red River. There has been a reduction in the annual occurrence and degree of backwater flooding in Spring Bayou Area since 1954, resulting in a decrease in spring turbidities and water level fluctation. The water cycle change has caused the establishments and spread of submerged vegetation throughout this system of shallow lakes.

2. A lotic plankton population was found in the sections sampled in the Amite River, with a progressive increase in production between upper and lower stations. This longitudinal order of plankton productivity correlated with decreases in dissolved oxygen and pH values and increases in carbon dioxide and total phosphates between upper and lower stations. Peaks in Spring Bayou Area net plankton counts and total plankton weights occurred during and following periods of backwater flooding. This increased plankton production correlated with maximum total phosphate and bicarbonate alkalinity values found during flooding from the Red River.

3. There was a progressive increase in production of benthic organisms from upper to lower regions of the Amite River. Bottom fauna counts and weights were maximal in winter and minimal in late spring and summer. Changes and trends in the Amite bottom fauna population were associated with peak and low flow records in the stream. Benthic populations from Spring Bayou Area exhibited a seasonal trend toward winter maximal and spring minimal counts, weights, and volumes.

4. High standing crop values of total fish, available size fish, and desirable predator-prey ratios were found each summer in Spring Bayou Area, although a reduction in the occurrence and extent of backwaters has occurred since 1954. Low standing crop values and predator-prey fish ratios found in the Amite River were similar to low values often found in infertile lotic areas of western Louisiana.

5. Adequate numbers of young of the year game fish species occurred in both areas throughout the study.

6. Chironomidae and Chaoborinae were major food items in summer diets of bluegill, redear sunfish and black crappie in Spring Bayou Area. There was a seasonal shift in feeding to non-benthic Amphipoda in winter collections of bluegill and crappie. Occurrence of large numbers of amphipods and Palemonidae in bluegill, crappie and largemouth bass stomachs indicate an important segment of the food chain in the backwater area was not sampled. Stomach samples from the Amite River were too few in number to indicate any seasonal trends in food items.

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CONSERVATION PLEDGE

I give my
pledge as an American
to save and faithfully to
defend from waste the
natural resources of
my country—its soil
and minerals, its
forests, waters,
and wildlife

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